

# Science

## Grade-Level Expectations

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Missouri Department of Elementary and Secondary Education  
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# **Grades K-3 Expectations**

# Standard 1: Properties and Principles of Matter and Energy

A. Properties and Structure of Matter				
Benchmark	Grade K	Grade 1	Grade 2	Grade 3
1. Objects, and the materials they are made of, have properties that can be used to describe and classify them	<i>Scope &amp; Sequence – Describing Objects and Materials</i> a. Describe physical properties of objects (size, shape, mass) by using the senses and/or simple tools (magnifier/centimeter ruler) b. Identify materials (cloth, paper, wood, metal, etc.) that make up an object and some of the properties of the materials (color, texture, shiny/dull) c. Sort objects based on observable properties (material, color, size, shape, mass)		<i>Scope &amp; Sequence - Matter</i> a. By using simple tools such as a magnifier, centimeter ruler and balance, collect data to describe the physical properties of objects	
ST	SC 1 1.2, 1.6		SC 1 1.2, 1.4	
2. Matter is anything that takes up space, has mass, and exists as solids, liquids or gases		<i>Scope &amp; Sequence – Balancing and Measuring</i> a. Measure the mass of objects using a balance b. Given a balance beam, a fulcrum, and various objects, illustrate arrangements in which the beam is balanced c. Compare the mass of objects d. Order objects according to mass	<i>Scope &amp; Sequence - Matter</i> a. Compare properties of water as a solid, liquid and gas b. Classify everyday objects/substances as solid, liquid or gas	
ST		SC 1 1.2, 1.6	SC 1 1.2, 1.8	
3. Objects and materials can change			<i>Scope &amp; Sequence - Matter</i> a. Predict the changes in the properties of objects when heated or cooled (melting, freezing, evaporation, condensation) b. Measure and compare the difference in temperature as water changes from a solid to a liquid or a liquid to a solid c. Record how various solids behave when mixed with water d. Give examples of different ways to separate mixtures	
ST			SC 1 1.2, 3.5	
B. Forms and Sources of Energy				
1. Forms of energy (sound and heat) have a source, a means of transfer and a receiver	<i>Scope &amp; Sequence - Sounds</i> a. Compare the different ways objects such as bells, whistles and glasses containing water can produce different sounds b. Create a list of sounds in our everyday life	<i>Scope &amp; Sequence – Observing Weather (SC5)</i> a. Describe the effect of the Sun’s heat on various objects b. Record the differences in temperature over time on different colored objects placed under a heat source	<i>Scope &amp; Sequence – Matter</i> a. List sources of heat that can change solids to liquids (sun, stove, fire, body) b. Give examples of sources of heat that can cause evaporation	<i>Scope &amp; Sequence – Forms of Energy: Sound</i> a. Give examples of sounds produced by objects and identify the sources of vibrations (blowing, plucking, tapping) b. Explore and describe different ways to change pitch (length, thickness, tension) c. Compare how sound travels through different materials (air in baggie, water, solids) d. Describe how the ear serves as a detector of sound
ST	SC 1 1.2, 2.1	SC 1 1.2, 4.1	SC 1 1.2, 1.6	SC 1 1.2, 3.5

Standard 2: Properties and Principles of Force and Motion

A. Motion				
Benchmark	Grade K	Grade 1	Grade 2	Grade 3
1. The position and motion of an object can be described by locating it relative to another object	<i>Scope &amp; Sequence – Relative Position</i> a. Describe an object’s position relative to another object (above, below, in front of, behind)	<i>Scope &amp; Sequence – Describing Motion</i> a. Compare the speeds (faster vs. slower) of two moving objects b. Compare the position of an object relative to another object (left of or right of) c. Describe an object’s motion as straight, circular or zigzag		
ST	SC 2 1.6	SC 2 1.6		
2. The way to change the position or motion of an object is to give it a push or pull (force)		<i>Scope &amp; Sequence – Describing Motion</i> a. Describe ways to change the motion of an object including going slower, going faster, going farther, changing direction or stopping. b. Describe ways the motion of an object may change	<i>Scope &amp; Sequence – Investigating Forces</i> a. Identify the force (push or pull) required to perform a task	
ST		SC 2 1.6	SC 2 3.6	
B. Forces				
1. A relationship exists between the strength of a force and its effect on the motion of an object			<i>Scope &amp; Sequence – Investigating Forces</i> a. Compare the distance traveled of objects with different masses while applying the same force b. Compare the distance traveled of objects with the same mass while applying different amounts of force	
ST			SC 2 1.4	
2. Forces act by making contact with an object (friction) or without touching an object (gravity, magnetism)	<i>Scope &amp; Sequence – Magnets</i> a. Show that magnets can be used to make some things move without being touched		<i>Scope &amp; Sequence – Investigating Forces</i> a. Show that magnets attract and repel each other b. Recognize the kinds of materials that are attracted to a magnet c. Describe magnetism as a force that can push or pull d. Describe gravity as a force that pulls e. Measure and compare the force required to overcome friction and move an object over different surfaces	
ST	SC 2 1.6		SC 2 3.1	
3. Ramps affect the force required to move an object			<i>Scope &amp; Sequence – Investigating Forces</i> a. Measure the amount of force it takes to pull an object up a ramp b. Measure, record and graph the distance an object travels after coming off ramps of different heights c. Apply the use of a ramp to different real life situations	
ST			SC 2 3.1	

# Standard 3: Characteristics and Interactions of Living Organisms

A. Characteristics of Organisms (Plants & Animals)				
Benchmark	Grade K	Grade 1	Grade 2	Grade 3
1. Plants and animals are alive and have characteristics and basic needs that make them different from non-living matter	<i>Scope &amp; Sequence – Plant and Animal Behaviors</i> a. Use the five senses to gather information about the structures and behaviors of plants and animals b. Explain how each sense was used to gather information	<i>Scope &amp; Sequence – Plant and Animal Characteristics</i> a. Identify characteristics of living and non-living things b. Sort living and non-living things in to groups c. Describe the basic needs of most animals (air, water, food and shelter) d. Describe the basic needs of most plants (air, water, light, nutrients and temperature) e. Conduct a fair test to investigate the effects of removing one of the needs of a plant on its growth (dark vs. light, water vs. no water, etc.)		
ST	SC 3 1.3, 1.6	SC 3 1.6, 2.3		
2. Observable characteristics of living organisms can be used to sort and group them		<i>Scope &amp; Sequence – Plant and Animal Characteristics</i> a. Compare plants based on physical characteristics (stem, leaves, flowers, etc.) b. Compare animals based on their physical characteristics (i.e. appendages, skin covering, eyes, beaks, etc.)		
ST		SC 3 1.6		
B. Structure and Function of Living Systems				
	Not tested at this grade level			
C. Reproduction and Heredity				
1. Organisms (plants and animals) go through life cycles			<i>Scope &amp; Sequence – Life Cycles of Plants and Animals</i> a. Record observations on the life cycle of different organisms b. Sequence the stages in the life cycle of a particular organism (butterfly, frog, bean plant, etc.)	
ST			SC 3 1.3, 1.6	
D. Change Over Time				
	Not tested at this grade level			

# Standard 4: Changes in Ecosystems and Interactions of Organisms With Their Environments

A. Populations and Ecosystems				
Benchmark	Grade K	Grade 1	Grade 2	Grade 3
1. All living organisms interact with each other and their environment in order to live and grow				<i>Scope &amp; Sequence – Interactions &amp; Interdependence of Organisms</i> a. Identify the ways a specific organism may interact with other organisms or with the environment (mimicry, camouflage, defensive mechanisms, etc.) b. Match and explain specific examples of producer/consumer and predator/prey relationships c. Sequence the flow of energy through a food chain d. Predict the possible effects of removing an organism from a food chain
ST				SC 4 1.1, 1.3, 1.6
2. Organisms exhibit behaviors that allow them to deal with changes in their environment (hibernation and migration)				<i>Scope &amp; Sequence – Interactions &amp; Interdependence of Organisms</i> a. Describe changes in animal behaviors and reactions to seasonal changes b. Collect and record data describing effects of an environmental change on a specific organism
ST				SC 4 1.6
B. Diversity and Adaptation				
1. Plants and animals have specialized structures that help them survive in their environment				<i>Scope &amp; Sequence – Interactions &amp; Interdependence of Organisms</i> a. Describe specialized structures that help plants survive in their environment (roots, cactus needles, thorns etc.) b. Describe specialized structures and senses that help animals survive in their environment (i.e. antennae, body covering, whiskers, appendages, etc.)
ST				SC 4 1.5, 1.6

# Standard 5: Process and Interactions of the Earth’s Systems

A. Geosphere				
Benchmark	Grade K	Grade 1	Grade 2	Grade 3
1. The Earth’s crust is composed of various materials including soil and rocks			<i>Scope &amp; Sequence – Earth Materials: Rocks &amp; Soils</i> a. Identify, compare and record the physical properties of soils (odor, appearance, grain size, texture and absorption of water) and components (sand, clay and humus) b. Identify, compare and record the physical properties of rocks (size, shape, color, presence of fossils, etc.) c. Observe common fossils of Missouri	
ST			SC 5 1.6	
2. The Earth’s materials are formed through a variety of processes			<i>Scope &amp; Sequence – Earth Materials: Rocks &amp; Soils</i> a. Observe and describe the breakdown of plant and animal material into soil through processes such as composting b. Observe the effects of freezing and thawing	
ST			SC 5 1.2	
B. Atmosphere, Weather and Climate				
1. Weather can be described by measurable properties	<i>Scope &amp; Sequence – Observing the Changes in Seasons</i> a. Observe and describe daily weather	<i>Scope &amp; Sequence – Observing Weather</i> a. Observe, measure and record weather using thermometers, rain gauges and weather vanes b. Observe and record cloud cover, precipitation, wind and temperature c. Summarize the weather data collected		
ST	SC 5 1.3, 1.6	SC 5 1.8		
C. Hydrosphere: Water – Water Cycle				
1. There is a water cycle				<i>Scope &amp; Sequence – Properties of Water/ Water Cycle</i> a. Investigate that water can freeze into a solid and then melt into a liquid again b. Investigate that water can evaporate into a gas and then condense into a liquid again c. Illustrate the water cycle
ST				SC 5 3.1
2. Water is an essential natural resource				<i>Scope &amp; Sequence – Properties of Water/ Water Cycle</i> a. Recognize the importance of water to living organisms
ST				SC 5 4.1
3. The water cycle has a major role in determining the weather and climate				<i>Scope &amp; Sequence – Properties of Water/ Water Cycle</i> a. Describe the water cycle as it applies to weather and climate
ST				SC 5 1.6

Standard 6: Composition and Structure of the Universe and the Motion of the Objects Within It

A. Earth, Moon and Sun				
Benchmark	Grade K	Grade 1	Grade 2	Grade 3
1. The positions of the Sun and Moon change in observable patterns				<i>Scope &amp; Sequence – Observing Patterns of the Sun, Moon and Shadows</i> a. Illustrate and describe how the Sun’s position in the sky changes over time during a day b. Be aware that the Sun can be seen only in the daytime, but the Moon can be seen sometimes at night and sometimes during the day c. Observe and describe how the Moon’s position in the sky changes over time d. Describe daytime as the time between when the Sun first appears over the horizon and disappears below the horizon e. Describe nighttime as the time between when the Sun disappears below the horizon and when the Sun first appears above the horizon
ST				SC 6 1.6
2. The shape of the Moon that can be seen from Earth changes in an observable pattern				<i>Scope &amp; Sequence – Observing Patterns of the Sun, Moon and Shadows</i> a. Observe and chart the appearance of the Moon and note the changes in what you see b. Discover the monthly repeating pattern of the appearance of the moon over several months (DO NOT TEACH OR TEST MOON PHASES)
ST				SC 6 1.6
3. The change in the Sun’s position relative to the Earth causes shadows to change				<i>Scope &amp; Sequence – Observing Patterns of the Sun, Moon and Shadows</i> a. Record the changes in the Sun’s position in the sky during the course of a day b. List and order the three things necessary to produce a shadow (light source, object and surface) c. Chart the shadow changes that are caused by changes in the Sun’s position in the sky d. Measure in centimeters the change in the length of the shadow cast by a vertical object as the Sun’s position in the sky changes e. Record the change of direction or position of a shadow from morning to midday to afternoon
ST				SC 6 1.6, 1.4, 3.5
4. Seasons can be observed as a change in weather over the course of a year	<i>Scope &amp; Sequence – Observing the Changes in Seasons</i> a. Observe and describe the characteristics of the four seasons b. Describe how the seasons affect the behavior of plants and animals c. Describe how the seasons affect everyday life			
ST	SC 6 1.6			



Standard 6: Composition and Structure of the Universe and the Motion of the Objects Within It  
(continued)

Benchmark	Grade K	Grade 1	Grade 2	Grade 3
B. Solar System				
	Not tested at this grade level			
C. Stars				
	Not tested at this grade level			
D. Gravitational Forces				
	Not tested at this grade level			

Standard 7: Processes of Scientific Inquiry

Benchmark	Grade K	Grade 1	Grade 2	Grade 3
1. Scientific inquiry includes the ability of students to develop and test scientifically oriented questions	<div>a. Raise questions about objects, materials, organisms and events in the environment</div> <div>b. Plan and conduct a simple investigation to answer questions</div>	<div>a. Raise questions about objects, materials, organisms, and events in the environment</div> <div>b. Plan and conduct a simple investigation to answer questions</div>	<div>a. Raise questions about objects, materials, organisms and events in the environment</div> <div>b. Plan and conduct a simple investigation to answer questions</div>	<div>a. Raise questions about objects, materials, organisms, and events in the environment</div> <div>b. Plan and conduct a simple investigation to answer questions</div>
ST	SC 7 1.1, 1.2	SC 7 1.1, 1.2	SC 7 1.1, 1.2	SC 7 1.1, 1.2
2. Scientific inquiry relies upon gathering evidence from qualitative and quantitative observations	<div>a. Observe using the five senses</div> <div>b. Observe using simple tools and equipment (hand lenses, magnets, balances)</div> <div>c. Measure length and weight using non-standard units</div> <div>d. Compare amounts</div>	<div>a. Observe using the five senses</div> <div>b. Observe using simple tools and equipment (hand lenses, magnets, balances)</div> <div>c. Measure length and weight using non-standard units</div> <div>d. Compare amounts</div>	<div>a. Observe using the five senses</div> <div>b. Observe using simple tools and equipment (hand lenses, magnets, balances, etc.)</div> <div>c. Measure length and weight using standard and non-standard units</div> <div>d. Compare amounts</div> <div>e. Judge whether measurements are reasonable</div>	<div>a. Observe using the five senses</div> <div>b. Observe using simple tools and equipment (hand lenses, magnets, balances, etc.)</div> <div>c. Measure length to the nearest centimeter</div> <div>d. Measure weight using non-standard units</div> <div>e. Compare amounts</div> <div>f. Judge whether measurements and computation of quantities are reasonable</div>
ST	SC 7 1.4	SC 7 1.4	SC 7 1.4, 1.7	SC 7 1.4, 1.7
3. Evidence is used to formulate explanations	<div>a. Use observations to construct reasonable explanations</div> <div>b. Use observations to describe relationships and make predictions</div>	<div>a. Use observations to construct reasonable explanations</div> <div>b. Use observations to describe relationships and make predictions</div>	<div>a. Use quantitative and qualitative data to construct reasonable explanations</div> <div>b. Use data to describe relationships and make predictions</div>	<div>a. Use quantitative and qualitative data to construct reasonable explanations</div> <div>b. Use data to describe relationships and make predictions</div>
ST	SC 7 1.6	SC 7 1.6	SC 7 1.6, 1.8	SC 7 1.6, 1.8
4. Scientific inquiry includes evaluation of explanations in light of scientific principles (understandings)	<div>a. Compare explanations with prior knowledge</div>	<div>a. Compare explanations with prior knowledge</div>	<div>a. Evaluate the reasonableness of an explanation</div> <div>b. Analyze whether evidence supports proposed explanations</div>	<div>a. Evaluate the reasonableness of an explanation</div> <div>b. Make predictions supported by scientific knowledge</div> <div>c. Analyze whether evidence supports proposed explanations</div>
ST	SC 7 1.7	SC 7 1.7	SC 7 1.7	SC 7 1.7
5. The nature of science relies upon communication of results and justification of explanations	<div>a. Communicate observations using words, pictures, and numbers</div>	<div>a. Communicate observations using words, pictures, and numbers</div>	<div>a. Communicate simple procedures and results of investigations and explanations through:<div>⇒ verbal explanations</div><div>⇒ drawings</div><div>⇒ data tables</div><div>⇒ graphs</div><div>⇒ writings</div></div>	<div>a. Communicate simple procedures and results of investigations and explanations through:<div>⇒ verbal explanations</div><div>⇒ drawings</div><div>⇒ data tables</div><div>⇒ graphs</div><div>⇒ writings</div></div> <div>b. Interpret data presented in writings, tables, graphs, and drawings</div>
ST	SC 7 2.1	SC 7 2.1	SC 7 1.8, 2.1	SC 7 1.8, 2.1

Standard 8: Impact of Science, Technology and Human Activity

A. The Nature of Technology				
Benchmark	Grade K	Grade 1	Grade 2	Grade 3
1. Tools that have been invented affect all areas of life				
the way things work				
drawbacks as well as benefits				
1. Technological innovations have played an important role in improving the quality of human life				
				SC 1 1.2, 3.5
2. People from different cultures, races, and of different gender have contributed to scientific discoveries and the invention of technological innovations				

# **Grades 4-7 Expectations**

# Standard 1: Properties and Principles of Matter and Energy

A. Properties and Structure of Matter				
Benchmark	Grade 4	Grade 5	Grade 6	Grade 7
1. Matter is anything that takes up space and has mass and exists in different states			<i>Scope &amp; Sequence – Examining Properties of Matter</i> a. Measure the amount of space an object takes up (volume) b. Measure the mass of samples of matter	
ST			SC 1 1.2, 1.4	
2. Matter exists as pure substances or mixtures of substances that have specific physical and chemical properties			<i>Scope &amp; Sequence – Examining Properties of Matter</i> a. Use appropriate tools (magnet, voltmeter, graduated cylinder, balance, thermometer) to describe a pure substance according to its properties (magnetic, conductivity, melting point, boiling point and solubility) b. Compare the properties of a pure substance (element or compound) to a mixture c. Identify the components and properties of different solutions d. Describe the variables that affect dissolving rate e. Using appropriate tools, separate a mixture using different methods (filtration, evaporation, chromatography, magnets)	
ST			SC 1 1.2, 1.4	
3. Matter can change physically and chemically			<i>Scope &amp; Sequence – Examining Properties of Matter</i> a. Identify chemical changes in common objects as a result of interactions with heat, light and air (rust, burning, color change) b. Identify physical changes in common objects	
ST			SC 1 1.6	
4. Matter is made up of moving particles too small to be seen	<i>Scope &amp; Sequence – Forms of Energy: Electricity</i> a. Develop a simple model that demonstrates the flow of invisible particles through an open or closed circuit	<i>Scope &amp; Sequence – Weather</i> a. Demonstrate how evaporation and condensation provide evidence that matter is made up of moving particles too small to seen		
ST	SC 1 1.8	SC 1 1.6		
B. Forms and Sources of Energy				
1. Forms of energy (electricity and light) have a source, a means of transfer and a receiver	<i>Scope &amp; Sequence – Forms of Energy: Electricity</i> a. Construct and diagram a complete electric circuit by using a source (battery), a means of transfer (wires) and a receiver (resistance bulbs, diodes, motors, fans) b. Observe and describe the effects of transferring energy from the source to the resistor (heat, light, sound and motion) c. Describe the advantages and disadvantages of series and parallel circuits d. Classify different materials as conductors or insulators			<i>Scope &amp; Sequence – Forms of Energy: Light</i> a. Identify producers of light b. Use appropriate tools (pinhole viewer, ray box and laser pointer) to show that light travels in a straight line c. Compare the reflection of light from various surfaces (mirrors) d. Conduct an investigation and compare the refraction of light passing through different materials (prisms, water, lenses, etc.) e. Using a prism illustrate and explain that white light is a mixture of many different colors of light that are visible to the human eye
ST	SC 1 1.6, 2.1			SC 1 1.2, 1.4, 1.6

Standard 1: Properties and Principles of Matter and Energy *(continued)*

Benchmark	Grade 4	Grade 5	Grade 6	Grade 7
2. Energy from the sun (solar radiation) is a major source of energy for weather phenomena		<i>Scope &amp; Sequence – Weather</i> a. Identify solar radiation as the source of energy for weather phenomena b. Graph and analyze the heating and cooling rates of soil and water c. Observe and describe the effect of surface temperature on the temperature and movement of the air above d. Describe the affect of differences in heating and cooling of land and water on weather patterns		
ST		SC 1 1.5, 1.6, 1.8		

Standard 2: Properties and Principles of Force and Motion

A. Motion				
Benchmark	Grade 4	Grade 5	Grade 6	Grade 7
1. The motion of an object can be described as a change in position, direction and speed	Scope & Sequence – Exploring Force & Energy a. Describe an object’s motion in terms of distance over time (speed)			Scope & Sequence – Exploring Forces a. Graphically represent an object’s motion in terms of distance vs. time (speed)
ST	SC 2 1.8			SC 2 1.8
2. An unbalanced force acting on an object changes its speed, direction of motion or both	Scope & Sequence – Exploring Force & Energy a. Compare the effects of balanced and unbalanced forces on an object’s motion b. Discuss how change of speed is affected by the amount of force and the mass of the object			
ST	SC 2 1.6			
3. Mechanical energy is the energy of movement or position of an object				Scope & Sequence – Exploring Forces a. Describe kinetic energy as the energy of motion and give examples b. Describe potential energy as the energy of position or condition and give examples
ST				SC 2 1.2, 1.6
B. Forces				
1. A relationship exists between the strength of a force and its effect on the motion of an object	Scope & Sequence – Exploring Motion a. Explain how increasing or decreasing the force affects the motion of an object b. Explain how the mass of an object affects the force required to move it			
ST	SC 2 1.2			
2. When forces are balanced, objects are at rest or stay constant				Scope & Sequence – Exploring Forces and Motion a. Describe the effects of balanced and unbalanced forces on an object’s motion b. Explain how the of the change of speed is affected by the amount of force and the mass of the object
ST				SC 2 1.6
3. There are different kinds of forces (magnetic, gravitational, frictional)	Scope & Sequence – Exploring Motion a. Describe gravity as a force that pulls. b. Identify friction as a force acting on moving objects c. Compare the effect of different materials and how they increase or decrease friction			
ST	SC 2 1.1			
4. Simple machines (levers, ramps and gears) can be used to affect the force applied to an object and/or direction of movement		Scope & Sequence – Simple Machines a. Explain how work can be done on an object (force applied and distance moved) b. Explain how simple machines change the amount or direction of force required c. Identify the simple machines in common tools and household items d. Describe how friction affects the amount of force needed to do work		Scope & Sequence – Exploring Forces and Motion a. Determine the amount of work done when a force is applied to an object over a distance
ST		SC 2 1.1, 1.2, 1.6		SC 2 1.2, 1.6

Standard 3: Characteristics and Interactions of Living Organisms

A. Characteristics of Organisms (Plants & Animals)				
Benchmark	Grade 4	Grade 5	Grade 6	Grade 7
1. Organisms can be classified into groups based on characteristics		<i>Scope &amp; Sequence – Classifying Living Things</i> a. Classify animals as vertebrates and invertebrates b. Classify animals into classes (amphibians, fish, birds, mammals and reptiles) c. Explain how characteristics of each class are the basis for classification d. Differentiate among the plant, animal, Protist, fungi and Moneran kingdoms using the characteristics of organisms (These will be the kingdoms used for assessment) e. Identify a plant or animal using a simple dichotomous key f. Explain the beneficial and detrimental impact of bacteria and fungi		
ST		SC 3 1.5, 1.6, 3.1, 3.6		
2. Organisms may have beneficial and/or detrimental impact on other organisms				<i>Scope &amp; Sequence – Interactions of Human Body Systems</i> a. Explain the beneficial or detrimental impact that organisms (viruses, bacteria, fungi and parasites) may have on human systems (i.e. diseases, vaccines, antibiotics)
ST				SC 3 1.6, 3.1, 3.6
3. Some diseases are the result of the breakdown within one or more body systems or at the cellular level				<i>Scope &amp; Sequence – Interactions of Human Body Systems</i> a. Explain the cause and effect of diseases on the human body (AIDS, cancer, MS, diabetes and hypertension)
ST				SC 3 3.1
B. Structure and Function of Living Systems				
1. All living things are made of cell(s) with structures that perform different functions			<i>Scope &amp; Sequence – Structure of Life</i> a. Compare and contrast plant, animal and other types of cells using microscopes and other tools b. Identify structures (nucleus, cell membrane, cell wall, chloroplasts, vacuoles, cytoplasm) within cells (plants vs. animals) c. Explain the function of the cell structures (nucleus, cell membrane, cell wall, chloroplasts, vacuoles, cytoplasm)	
ST			SC 3 1.4, 1.5	
2. Multi-cellular organisms are interacting systems of cells, tissues, organs and organ networks that carry out life processes			<i>Scope &amp; Sequence – Structure of Life</i> a. Identify and give examples of each level of organization (i.e. examples of tissues and examples of organs, etc.)	
ST			SC 3 1.5, 1.6	



### Standard 3: Characteristics and Interactions of Living Organisms *(continued)*

B. Structure and Function of Living Systems <i>(cont.)</i>				
Benchmark	Grade 4	Grade 5	Grade 6	Grade 7
3. Humans have interacting systems for digestion, respiration, reproduction, circulation, excretion, movement, control and coordination and for protection from diseases				<i>Scope &amp; Sequence – Interacting Systems in Humans</i> <ul style="list-style-type: none"><li>• Illustrate and explain the path nutrients take as they are processed by the digestive system, pass into the blood stream and are transported into the cell</li><li>• Illustrate and describe the path oxygen takes as it enters the body, passes into the blood stream and is transported into the cell</li><li>• Illustrate and describe the path an impulse may take due to a stimulus and the appropriate response that may result</li><li>• Identify the different body systems and explain the need for interaction</li></ul>
ST				SC 3 3.1
4. Cellular activities and responses can maintain stability internally while external conditions are changing				<i>Scope &amp; Sequence – Interacting Systems in Humans</i> <ul style="list-style-type: none"><li>• Given a scenario, predict the response the human body may take to maintain internal balance during an environmental change</li></ul>
ST				SC 3 3.5
C. Reproduction and Heredity				
1. Reproduction is essential to the continuation of every species			<i>Scope &amp; Sequence – Structure of Life</i> <ul style="list-style-type: none"><li>• Explain the importance of reproduction</li><li>• Explain why cells need to grow and divide</li></ul>	
ST			SC 3 1.1, 3.5	
2. Sexual reproduction in plants and animals allows for variation			<i>Scope &amp; Sequence – Structure of Life</i> <ul style="list-style-type: none"><li>• Compare and contrast asexual and sexual reproduction</li><li>• Describe the advantages and disadvantages of asexual and sexual reproduction</li></ul>	
ST			SC 3 3.1	
3. Chromosomes carry the genetic information that determines heredity			<i>Scope &amp; Sequence – Structure of Life</i> <ul style="list-style-type: none"><li>• Identify chromosomes as the component of cells that occur in pairs and carry heredity information</li><li>• Describe how genetic material is transmitted resulting in offspring showing traits from both parents (No mitosis or meiosis at this level)</li></ul>	
ST				
D. Change Over Time				
	Not tested at this grade level			

Standard 4: Changes in Ecosystems and Interactions of Organisms With Their Environments

A. Populations and Ecosystems				
Benchmark	Grade 4	Grade 5	Grade 6	Grade 7
1. All populations living together and the physical factors with which they interact compose an ecosystem	<i>Scope &amp; Sequence - Ecosystems</i> a. Categorize populations of organisms as producers, consumers and decomposers by the role they serve in the ecosystem		<i>Scope &amp; Sequence – Ecology: Populations</i> a. Identify the biotic and abiotic factors that would affect the population number of particular organisms that an ecosystem could support b. Predict how abiotic and biotic factors determine the populations within an ecosystem	
ST	SC 4 1.6		SC 4 3.1	
2. As energy flows through the ecosystem, all organisms must capture the portion of energy available to them and transform it to a usable form	<i>Scope &amp; Sequence - Ecosystems</i> a. Explain how plants produce their own food b. Differentiate between the three types of consumers (herbivore, carnivore and omnivore) c. Describe the flow of energy through a food chain		<i>Scope &amp; Sequence – Ecology: Populations</i> a. Diagram and describe the flow of energy in an energy pyramid for a given population	
ST	SC 4 4.1		SC 4 2.1, 1.1	
3. Matter is recycled in an ecosystem			<i>Scope &amp; Sequence – Ecology: Populations</i> a. Illustrate the recycling of matter in the water, nitrogen and carbon cycles b. Describe the effects of organisms on the matter within these cycles	
ST			SC 4 1.1	
4. All organisms, including humans and their activities, cause changes in their environments that can be either beneficial or harmful to the organisms in the ecosystem	<i>Scope &amp; Sequence - Ecosystems</i> a. Observe and describe beneficial and harmful activities that affect an ecosystem b. Identify examples in Missouri where human activity has had a beneficial or harmful effect on organisms		<i>Scope &amp; Sequence – Ecology: Populations</i> a. Describe beneficial and harmful activities of organisms, including humans, that affect an ecosystem	
ST	SC 4 3.6		SC 4 3.6	
B. Diversity and Adaptation				
	Not test at this grade level			

Standard 5: Process and Interactions of the Earth’s Systems

A. Geosphere				
Benchmark	Grade 4	Grade 5	Grade 6	Grade 7
1. The Earth’s crust is composed of various materials including soils, rocks and minerals	<i>Scope &amp; Sequence – Classification of Rocks and Minerals</i> <ul style="list-style-type: none"><li>Identify and classify samples of earth materials into rocks or mineral</li><li>Differentiate between rocks and minerals</li><li>Identify minerals using color, texture, smell, luster, hardness, shape and reaction to magnets</li><li>Observe and describe different types of rocks according to properties such as color, texture and layering</li></ul>			
ST	SC 5 1.2			
2. The Earth’s materials are formed through a variety of processes	<i>Scope &amp; Sequence – Classification of Rocks &amp; Minerals</i> <ul style="list-style-type: none"><li>Describe the different ways rocks are formed</li><li>Classify rocks as igneous, sedimentary and metamorphic</li></ul>		<i>Scope &amp; Sequence – Earth Processes: Earthquakes &amp; Volcanoes</i> <ul style="list-style-type: none"><li>Classify rocks by their chemical and physical properties and the processes that formed them</li><li>Recognize that rocks can cycle from one type to another through the Earth’s internal and external processes</li></ul>	
ST	SC 5		SC 5	
3. The Earth’s surface is constantly changing due to the process of weathering, erosion and human interactions with the Earth		<i>Scope &amp; Sequence – Earth Processes: Weathering &amp; Erosion</i> <ul style="list-style-type: none"><li>Provide examples of where weathering by water, wind, glaciation and plants have changed the surface of the earth</li><li>Observe and describe evidence that waves, wind, water and ice shape and reshape the Earth’s surface by eroding rock and soil</li><li>Investigate the variables (amount of water, time, slope) that influence erosion and deposition of Earth’s surface materials</li><li>Analyze the ways humans affect erosion and deposition through the clearing of land, planting vegetation and building dams</li></ul>		
ST		SC 5 3.1		

Standard 5: Process and Interactions of the Earth’s Systems *(continued)*

Benchmark	Grade 4	Grade 5	Grade 6	Grade 7
4. There are internal processes that change the surface of the Earth			<i>Scope &amp; Sequence – Earth Processes: Earthquakes &amp; Volcanoes</i> a. Investigate the abrupt changes in the Earth’s surface that result from earthquakes and volcanic eruptions b. Use data on the location of earthquakes and volcanoes to infer the existence of plates of the Earth’s crust c. Illustrate the three main belts of intense earthquake and volcanic activity and relate the belts to the movement of crustal plates d. Identify the major plates that make up the Earth’s crust e. Compare and contrast different types of plate boundaries f. Investigate data from earthquakes, volcanoes and sea floor spreading that provide evidence for crustal plates and their movement of crustal plates (Theory of Plate Tectonics) g. Present evidence on the theory that a single super continent once existed h. Illustrate the landforms that result when crustal plates collide, separate and slide past one another	
ST			SC 5 1.4, 1.6	
5. The geosphere consists of specific zones that each have unique distinguishable characteristics			<i>Scope &amp; Sequence – Earth Processes: Earthquakes &amp; Volcanoes</i> a. Illustrate, label, and describe Earth’s layers: crust, mantle, inner, and outer core b. Describe how the energy of an earthquake travels (seismic waves)	
ST			SC 5 1.3, 1.5, 1.6	
B. Atmosphere, Weather and Climate				
1. Properties of weather such as cloud cover, precipitation, wind speed and direction, temperature and pressure can be observed and measured to predict weather changes		<i>Scope &amp; Sequence - Weather</i> a. Collect and analyze weather data by using a variety of instruments (such as satellites, Doppler radar, barometers, thermometers, anemometers, wind vanes, hygrometers) b. Predict probable weather conditions using current weather data		
ST		SC 5 1.4, 3.5		
2. Dramatic changes in the pressure, temperature and wind create powerful forces that can affect our planet and living thing that inhabit it		<i>Scope &amp; Sequence - Weather</i> a. Describe the conditions necessary for tornadoes, hurricanes and/or storms to form b. Describe the impact of tornadoes, hurricanes and storms on Earth		
ST		SC 5 1.6, 3.1		

Standard 5: Process and Interactions of the Earth’s Systems *(continued)*

C. Hydrosphere: Water – Water Cycle				
Benchmark	Grade 4	Grade 5	Grade 6	Grade 7
1. The ability of water to change forms as it moves through a system is called the water cycle		<i>Scope &amp; Sequence - Weather</i> a. Explain and trace the path of water through the Earth’s systems known as the water cycle b. Demonstrate how water in liquid, solid and gaseous state is constantly being recycled c. Provide examples of how humans and other living organisms depend on the water cycle d. Describe how humans and other organisms affect the water cycle		
ST		SC 5 1.3, 1.6, 3.4		
2. The water cycle occurs because of heating and cooling and involves the processes of convection and radiation		<i>Scope &amp; Sequence - Weather</i> a. Explain using words and drawings how heating and cooling affect the arrangement and motion of particles		
ST		SC 5 1.6, 2.1		
3. Matter is made up of particles too small to be seen		<i>Scope &amp; Sequence - Weather</i> a. Demonstrate how evaporation and condensation provide evidence that matter is made up of particles too small to be seen		
ST		SC 5 3.5		

Standard 6: Composition and Structure of the Universe and the Motion of the Objects Within It

A. Earth, Moon and Sun				
Benchmark	Grade 4	Grade 5	Grade 6	Grade 7
1. Time (day, month and year) can be measured by observing the natural cycles of the Sun and Moon				<i>Scope &amp; Sequence – Earth and Space</i> a. Illustrate and explain the daily rotation of the Earth and the conditions that create sunrise, sunset, solar noon and midnight b. Chart the changes in the shape of the lit portion of the Moon that can be seen from Earth on a day-to-day cycle that lasts about a month; name and order the phases of the Moon (Put pictures of the Moon’s phases in order of occurrence and name the phases; cause of Moon phases not tested on the MAP) c. Demonstrate using a model that shows how the Earth revolves around the Sun d. Observe and chart that throughout the school year, the Sun at solar noon is higher in the warmer months and lower in the colder months by observing the length and positions of shadows e. Illustrate and explain a year as the time it takes the Earth to revolve around the Sun (which can be observed on Earth as the time between absolute shortest shadows or absolute longest shadows)
ST				SC 6 1.8, 3.1
B. Forms and Sources of Energy				
1. The Earth is the third planet from the Sun in a system that includes the Moon, the Sun, eight other planet and their moons, and smaller objects such as asteroids, comets and meteoroids				<i>Scope &amp; Sequence – Earth and Space</i> a. Compare the size and position of the Sun to the rest of the objects in the solar system b. Create scale models of the solar system that are accurate in both size and distance c. Compare and contrast the size, composition and surface of the nine planets in our solar system d. Explain the characteristics of Earth that support life
ST				SC 6 1.2
2. The Sun, Moon, stars and planets appear to move from east to west each day				<i>Scope &amp; Sequence – Earth and Space</i> a. Observe, describe, and simulate how the Sun, Moon, stars and planets change position in the sky over the course of a day
ST				SC 6 1.6
C. Stars				
	Not tested at this grade level			
D. Gravitational Forces				
	Not tested at this grade level			

# Standard 7: Processes of Scientific Inquiry

Benchmark	Grade 4	Grade 5	Grade 6	Grade 7
<b>1.Scientific inquiry includes the ability of students to develop and test scientifically oriented questions</b>	<ul style="list-style-type: none"><li>a. Formulate testable questions</li><li>b. Conduct a fair test to answer a question</li><li>c. Recognize the characteristics of a fair test</li></ul>	<ul style="list-style-type: none"><li>a. Formulate testable questions</li><li>b. Conduct a fair test to answer a question</li><li>c. Recognize the characteristics of a fair test</li></ul>	<ul style="list-style-type: none"><li>a. Formulate testable questions</li><li>b. Design and conduct (with guidance) a valid experiment including manipulation of only one variable and multiple trials</li><li>c. Evaluate the design of an experiment</li></ul>	<ul style="list-style-type: none"><li>a. Formulate testable questions</li><li>b. Design and conduct a valid experiment including manipulation of only one variable and multiple trials</li><li>c. Evaluate the design of an experiment</li></ul>
ST	SC 7 1.1, 1.2	SC 7 1.1, 1.2	SC 7 1.1, 1.2	SC 7 1.1, 1.2
<b>2. Scientific inquiry relies upon gathering evidence from qualitative and quantitative observations</b>	<ul style="list-style-type: none"><li>a. Observe using simple tools and equipment (hand lenses, magnets, balances, etc.)</li><li>b. Measure length to the nearest centimeter</li><li>c. Measure mass to the nearest gram</li><li>d. Measure temperature to the nearest degree</li></ul>	<ul style="list-style-type: none"><li>a. Use a variety of tools and equipment to gather data</li><li>b. Measure length to the nearest centimeter</li><li>c. Measure mass to the nearest gram</li><li>d. Measure volume to the nearest milliliter</li><li>e. Measure temperature to the nearest degree</li><li>f. Determine the appropriate tools and techniques to collect data</li></ul>	<ul style="list-style-type: none"><li>a. Use a variety of tools and equipment to gather data (microscopes, thermometers, computers, spring scales, balances, and graduated cylinders, etc.)</li><li>b. Measure length to the nearest millimeter, mass to the nearest gram, volume to the nearest milliliter, temperature to the nearest degree, weight to the nearest Newton</li><li>c. Determine the appropriate tools and techniques to collect data</li></ul>	<ul style="list-style-type: none"><li>a. Use a variety of tools and equipment to gather data (microscopes, thermometers, analog and digital meters, computers, spring scales, balances, and graduated cylinders, etc.)</li><li>b. Measure length to the nearest millimeter, mass to the nearest gram, volume to the nearest milliliter, weight to the nearest Newton</li><li>c. Determine the appropriate tools and techniques to collect, analyze, and interpret data</li><li>d. Find the mean, median, and mode for sets of data</li></ul>
ST	SC 7 1.4, 1.8	SC 7 1.4, 1.8	SC 7 1.4, 1.8	SC 7 1.4, 1.8
<b>4. Scientific inquiry includes evaluation of explanations in light of scientific principles (understandings)</b>	<ul style="list-style-type: none"><li>a. Evaluate the reasonableness of an explanation</li><li>b. Make predictions supported by scientific knowledge</li><li>c. Analyze whether evidence supports proposed explanations</li><li>d. Recognize that explanations have changed over time as a result of new evidence</li></ul>	<ul style="list-style-type: none"><li>a. Evaluate the reasonableness of an explanation</li><li>b. Make predictions supported by scientific knowledge</li><li>c. Analyze whether evidence supports proposed explanations</li><li>d. Recognize that explanations have changed over time as a result of new evidence</li></ul>	<ul style="list-style-type: none"><li>a. Evaluate the reasonableness of an explanation</li><li>b. Make predictions supported by scientific knowledge</li><li>Analyze whether evidence supports proposed explanations</li><li>c. Recognize that explanations have changed over time as a result of new evidence</li></ul>	<ul style="list-style-type: none"><li>a. Evaluate the reasonableness of an explanation</li><li>b. Make predictions supported by scientific knowledge</li><li>c. Analyze whether evidence supports proposed explanations</li><li>d. Recognize that explanations have changed over time as a result of new evidence</li></ul>
ST	SC 7 1.6, 3.5, 4.1	SC 7 1.6, 3.5, 4.1	SC 7 1.6, 3.5, 4.1	SC 7 1.6, 3.5, 4.1
<b>5. The nature of science relies upon communication of results and justification of explanations</b>	<ul style="list-style-type: none"><li>a. Communicate the procedures and results of investigations and explanations through:<ul style="list-style-type: none"><li>⇒ verbal explanations</li><li>⇒ drawings</li><li>⇒ data tables</li><li>⇒ graphs</li><li>⇒ writings</li></ul></li></ul>	<ul style="list-style-type: none"><li>a. Communicate the procedures and results of investigations and explanations through:<ul style="list-style-type: none"><li>⇒ verbal explanations</li><li>⇒ drawings</li><li>⇒ data tables</li><li>⇒ graphs</li><li>⇒ writings</li></ul></li></ul>	<ul style="list-style-type: none"><li>a. Communicate the procedures and results of investigations and explanations through:<ul style="list-style-type: none"><li>⇒ verbal explanations</li><li>⇒ drawings</li><li>⇒ data tables</li><li>⇒ graphs</li><li>⇒ writings</li></ul></li></ul>	<ul style="list-style-type: none"><li>a. Communicate the procedures and results of investigations and explanations through:<ul style="list-style-type: none"><li>⇒ verbal explanations</li><li>⇒ drawings</li><li>⇒ data tables</li><li>⇒ graphs</li><li>⇒ writings</li></ul></li></ul>
ST	SC 7 1.8, 2.1	SC 7 1.8, 2.1	SC 7 1.8, 2.1	SC 7 1.8, 2.1

Standard 8: Impact of Science, Technology and Human Activity

A. The Nature of Technology				
Benchmark	Grade 4	Grade 5	Grade 6	Grade 7
1. Technology extends the ability of people to change the way things work				
society are often complex and involve risk/benefit trade-offs				
1. Technological innovations have played an important role in improving the quality of human life				
different gender have contributed to scientific discoveries and the invention of technological innovations				
1. Society and the environment are directly influenced by the discoveries of science and products of technology				



# **Grades 8-10 Expectations**

# Standard 1: Properties and Principles of Matter and Energy

A. Properties and Structure of Matter	
Benchmark	Grades 8, 9, 10
1. Matter has specific physical properties	<i>Scope &amp; Sequence – Properties of Matter – Elements</i> a. Measure the volume and mass of matter and calculate its density b. Compare the property of density for different samples of matter
ST	SC 1 1.2, 1.4
2. The periodic table organizes the elements according to their atomic structure and chemical reactivity	<i>Scope &amp; Sequence – Properties of Matter - Elements</i> a. Explain the structure of the periodic table in terms of the elements with common properties (groups/families) and repeating properties (periods) b. Contrast the common properties of metal and nonmetals and their location in the periodic table c. Explore the relationship of chemical reactivity and position on the periodic table
ST	SC 1 1.6, 3.5
3. Properties of mixtures depend upon the concentrations, properties and interactions of particles	<i>Scope &amp; Sequence – Properties of Matter - Mixtures</i> a. Qualitatively distinguish between the types of solutions (dilute, concentrated, saturated, supersaturated) b. Organize examples of mixtures into heterogeneous and homogeneous (solutions) categories c. Compare and contrast the properties of acid and basic and neutral solutions
ST	SC 1 1.2, 1.6
4. The atomic model describes the electrically neutral atom	<i>Scope &amp; Sequence – Structure of Matter</i> a. Classify the three main subatomic particles according to location in an atom, charge and mass b. Calculate the numbers of protons, neutrons, and electrons of an element (or isotopes) given its atomic mass (or mass number) c. Describe the information provided by the atomic number and the mass number d. Diagram an atom as shown in the shell model
ST	SC 1 1.6, 3.5
5. Chemical bonding is the combining of elements to form new substances with definite properties	<i>Scope &amp; Sequence – Changes in Matter</i> a. Explain why atoms form chemical bonds b. Describe the role of electrons in chemical bonding (valence electrons)
ST	SC 1 1.6, 2.4
B. Forms and Sources of Energy	
1. Energy is the measure of actual or potential change in matter and can be classified in various ways	<i>Scope &amp; Sequence – Energy Transfer</i> a. Examine various forms of energy and their properties b. Classify changes in energy including chemical, nuclear, thermal, mechanical, electrical c. Construct a phase change diagram showing the relationship between temperature and energy absorbed or released
ST	SC 1 1.2, 1.8, 3.5
2. The total energy of the universe is constant and can be transferred in various ways	<i>Scope &amp; Sequence – Energy Transfer</i> a. Using the law of conservation of energy; explain how energy can be transferred or transformed but not lost
ST	SC 1 1.3, 1.8

Standard 1: Properties and Principles of Matter and Energy *(continued)*

B. Forms and Sources of Energy <i>(continued)</i>	
Benchmark	Grades 8, 9, 10
3. Thermal changes and certain physical properties of substances (melting point, boiling point, specific heat) are explained by the kinetic theory of matter	<i>Scope &amp; Sequence – Energy Transfer</i> a. Relate heat (thermal energy) to moving particles (molecules or atoms) b. Differentiate between heat (thermal energy) and temperature c. Interpret examples of thermal energy transfer as convection, conduction or radiation
ST	SC 1 1.3, 1.4, 2.4
4. Nuclear reactions are changes in the nucleus of the atom	<i>Scope &amp; Sequence – Energy Transfer</i> a. Identify the source of radioactivity (stability of the nucleus) b. Compare and contrast the properties of the three different types of radioactive decay c. Compare and contrast a nuclear chain reaction (fission) and the process of fusion d. Interpret data from the decay of a radioactive sample over time (table or graph)
ST	SC 1 1.2, 1.5, 1.6, 1.8, 3.5
5. Chemical reactions involve changes in the bonding of atoms	<i>Scope &amp; Sequence – Energy Transfer</i> a. Describe the relationship between chemical bonds and chemical changes b. Compare the mass of the reactants to the mass of the products in a chemical reaction as support for the Law of Conservation of Mass
ST	SC 1 1.2, 1.3, 3.5

Standard 2: Properties and Principles of Force and Motion

A. Motion	
Benchmark	Grades 8, 9, 10
1. Motion involves a change in position during a certain period of time	<i>Scope &amp; Sequence – Describing Motion</i> a. Compare the speed of two objects in terms of distance and time b. Interpret the motion of an object from a distance vs. time graph c. Distinguish between speed and velocity
ST	SC 2 3.1
2. An object that is accelerating is speeding up, slowing down or changing direction	<i>Scope &amp; Sequence – Describing Motion</i> a. Describe the acceleration of an object in terms of its velocity over a period of time b. Measure and analyze an object’s motion in terms of speed, velocity and acceleration
ST	SC 2 2.2
3. Momentum depends on the mass of the object and the velocity with which it is traveling	<i>Scope &amp; Sequence – Describing Motion</i> a. Compare the momentum of two objects in terms of mass and velocity b. Describe how the total momentum remains constant in a system
ST	SC 2 1.6
B. Forces	
1. Circular motion requires a force directed towards the center of a circle and projectile motion requires a force acting down	<i>Scope &amp; Sequence – How Forces Affect Motion</i> a. Describe the force that keeps an object traveling in a circular path
ST	SC 2 1.6
2. The overall effect of many forces acting on an object at the same time is called a net force; the size and direction of this net force determines the change in motion of an object (Newton’s Laws of Motion)	<i>Scope &amp; Sequence – How Forces Affect Motion</i> a. Describe inertia (a property of matter in which an object at rest tends to remain at rest or an object in motion tends to remain in motion unless acted upon by an unbalanced force) in terms of mass and explain how it affects motion b. Using information about the mass and acceleration of two objects, compare the force required to move them (force = mass x acceleration) c. Predict the action/reaction forces acting between two objects in an everyday example (i.e. handball hits concrete wall)
ST	SC 2 1.6
3. In most situations, frictional forces complicate the description of motion although the basic principles still apply	<i>Scope &amp; Sequence – How Forces Affect Motion</i> a. Describe how frictional forces cause objects to slow down and/or eventually stop b. Discuss how frictional forces cause objects to fall at different rates
ST	SC 2 3.6
4. Every object exerts a force on every other object; its magnitude depends on the masses of the objects and the distance between them	<i>Scope &amp; Sequence – Work and Energy</i> a. Compare and describe the gravitational force between two objects b. Describe weight in terms of the mass of an object and the acceleration due to gravity
ST	SC 2 1.6
5. Mechanical energy comes from the motion (kinetic energy) and/or position (potential energy) of an object	<i>Scope &amp; Sequence – Work and Energy</i> a. Relate kinetic energy to an object’s mass and its velocity b. Relate an object’s potential energy to its weight and height c. Describe the conversion between potential energy and kinetic energy of a given moving object (i.e. tennis ball dropping, pendulum swinging); predict where kinetic and potential energies are the greatest and least in the motion
ST	SC 2 1.6
6. The work done on an object depends on both the applied force and the distance the object moves	<i>Scope &amp; Sequence – Work and Energy</i> a. Compare the relationship between work, force applied to an object and the distance the object moves b. Describe how work can change an object’s kinetic energy, potential energy or both c. Describe power in terms of work and time d. Explain how the efficiency of machines can be expressed as a ratio of work done to energy
ST	SC 2 1.1, 1.6

Standard 2: Properties and Principles of Force and Motion *(continued)*

Benchmark	Grades 8, 9, 10
7. Moving electric charges produce magnetic fields that exert a magnetic force on other objects	<i>Scope &amp; Sequence – Work and Energy</i> a. Discuss how magnetism is used to produce electricity b. Explain that moving electric charges produce a magnetic field c. Compare and contrast the energy conversions in a generator with those of an electric motor
ST	SC 2 3.1

# Standard 3: Characteristics and Interactions of Living Organisms

A. Characteristics of Organisms (Plants & Animals)	
Benchmark	Grades 8, 9, 10
1. All living organisms have DNA which is the genetic material that determines hereditary characteristics	<i>Scope &amp; Sequence - DNA</i> a. Illustrate the structure of DNA, including the correct pairing of nitrogen bases b. Explain how the vertical sequencing nitrogen base pairs determine characteristics
ST	SC 3 1.6, 1.8
2. Coding errors in DNA synthesis (mutation) can occur randomly during replication and can also be caused by heat, radiation, and certain chemicals	<i>Scope &amp; Sequence - DNA</i> a. Explain how an error in the DNA code can be transferred during replication b. Identify possible external causes of DNA mutations
ST	SC 3 3.1
B. Structure and Function of Living Systems	
1. Plants and many microorganisms use solar energy to carry out the process of photosynthesis, which provides a connection between the Sun and living organisms	<i>Scope &amp; Sequence – Energy Transfer Within Cells</i> a. Summarize how energy transfer occurs during photosynthesis ( the storage and release of energy in the bonds of chemical compounds)
ST	SC 3 1.5, 1.6
2. Photosynthesis and cellular respiration are complimentary processes	<i>Scope &amp; Sequence – Energy Transfer Within Cells</i> a. Compare and contrast photosynthesis and cellular respiration b. Compare and contrast the purpose, structure, and role of mitochondria and chloroplasts
ST	SC 3 1.6
3. Cells carry out chemical transformations that allow conversion of energy from one form to another, the breakdown of molecules into smaller units and the building of larger molecules from smaller ones	<i>Scope &amp; Sequence – Energy Transfer Within Cells</i> a. Compare and contrast anabolic and catabolic processes
ST	SC 3 1.6
4. The genetic information stored in DNA dictates protein synthesis	<i>Scope &amp; Sequence – Energy Transfer Within Cells</i> a. Explain how the DNA code determines the sequence of amino acids in a protein
ST	SC 3 1.6
5. Most cell functions involve chemical reactions that are controlled by enzymes	<i>Scope &amp; Sequence – Energy Transfer Within Cells</i> a. Explain how enzymes speed up chemical reactions. b. Interpret a data table showing the effects of an enzyme on a chemical reaction
ST	SC 3 1.6
6. Homeostasis is maintained in organisms as a result of special functions performed at the cellular level using transport systems (diffusion, osmosis, active transport, phagocytosis and pinocytosis)	<i>Scope &amp; Sequence – Energy Transfer Within Cells</i> a. Explain how concentration gradients affect the transport of molecules
ST	SC 3 1.6

Standard 3: Characteristics and Interactions of Living Organisms *(continued)*

C. Reproduction and Heredity	
Benchmark	Grades 8, 9, 10
1. The pattern of inheritance for many traits can be predicted by using the principles of Mendelian genetics	<i>Scope &amp; Sequence – Genetics</i> a. Predict the probability of the occurrence of specific traits in an offspring by using a monohybrid cross
ST	SC 3 1.6, 1.8
2. Chromosomes are components of cells that occur in pairs and carry hereditary information from one cell to its daughter cell and from a parent to its offspring	<i>Scope &amp; Sequence – Genetics</i> a. Explain how sexual reproduction perpetuates plant and animal life b. Identify organisms that reproduce sexually with sperm and egg c. Explain how DNA of parent cells replicates to form identical chromosomes in daughter cells (asexual reproduction of unicellular organisms and mitosis in multi-cellular organisms) d. Compare mitosis and meiosis and explain the advantages and disadvantages of each
ST	SC 3 3.1
D. Change Over Time	
1. Similarities in DNA and protein structure can be used to classify and determine degrees of similarities among organisms	<i>Scope &amp; Sequence – Natural Selection</i> a. Compare the genetic structure of different organisms b. Using data, analyze the possible implications of genetic similarities
ST	SC 3 1.8
2. Natural selection favors the organism whose behavior is flexible enough to deal with changing environments and whose traits allow reproductive success and survival	<i>Scope &amp; Sequence – Natural Selection</i> a. Select and justify scenarios that best represent the concept of natural selection
ST	SC 3 1.6
3. The process of natural selection provides some advantage of survival to individuals within a species due to mutation and recombination of certain heritable variations	<i>Scope &amp; Sequence – Natural Selection</i> a. Identify various factors that could enhance the chances for survival of an organism due to natural selection
ST	SC 3 3.1

# Standard 4: Changes in Ecosystems and Interactions of Organisms With Their Environments

A. Populations and Ecosystems	
Benchmark	Grades 8, 9, 10
1. The cycling of matter helps maintain a balanced system	<i>Scope &amp; Sequence – Ecological Cycles</i> a. Trace nitrogen and carbon through an ecosystem b. Explain the importance of cycles within an ecosystem
ST	SC 4 1.1, 1.6
2. Energy flows through ecosystems in one direction, from photosynthetic organisms to herbivores, to carnivores and decomposers	<i>Scope &amp; Sequence – Ecological Cycles</i> a. Illustrate and describe the flow of energy within a food web b. Calculate the available energy of each trophic level within a food web
ST	SC 4 1.8
3. Organisms both cooperate and compete in ecosystems and therefore may generate ecosystems that are stable for years	<i>Scope &amp; Sequence – Relationships Within Ecosystems</i> a. Identify the relationships of mutualism, commensalism, parasitism, and predator/prey that are present in a given scenario b. Explain how cooperative and competitive relationships help maintain balance within an ecosystem
ST	SC 4 3.5
4. Living organisms have the capacity to produce populations of infinite size but environments and resources are finite	<i>Scope &amp; Sequence – Relationships Within Ecosystems</i> a. Identify and explain the factors that may affect the carrying capacity of an organism within an ecosystem
ST	SC 4 3.1
5. Human decisions concerning the use of resources alter the stability and biodiversity of ecosystems (i.e. destruction caused by direct harvesting, pollution, atmospheric changes, etc.)	<i>Scope &amp; Sequence – Ecological Diversity</i> a. List examples of human efforts to improve the balance or diversity in an ecosystem b. Devise a multi-step plan to regain the stability and/or biodiversity of an ecosystem
ST	SC 4 3.8
6. No two species occupy the same niche in an ecosystem so that different species can coexist and help maintain the stability of that system	<i>Scope &amp; Sequence – Ecological Biodiversity</i> a. Give examples of competitors in a given ecosystem b. Describe behaviors and circumstances that would allow competitors in an ecosystem to co-exist
ST	SC 4 4.1
7. Biological, chemical and physical processes interconnect ecosystems so that changes in one ecosystem may have local or global consequences	<i>Scope &amp; Sequence – Interactions of Ecosystems</i> a. Predict how changes in one ecosystem may affect another ecosystem
ST	SC 4 1.2
B. Diversity and Adaptation	
1. The variety of organisms in an ecosystem changes when environmental conditions change; this can be beneficial or harmful to organisms	<i>Scope &amp; Sequence – Environmental Changes and Extinction</i> a. Predict the impact of an environmental change on the variety of organisms in an ecosystem
ST	SC 4 3.6
2. Extinction of a species occurs when the environment changes and the species is unable to adapt	<i>Scope &amp; Sequence – Environmental Changes and Extinction</i> a. Analyze possible causes of extinction of a species b. Given a scenario, hypothesize why a given species was unable to survive
ST	SC 4 4.1



Standard 5: Process and Interactions of the Earth’s Systems

A. Geosphere	
Benchmark	Grades 8, 9, 10
1. There are energy sources within the Earth that cause convection currents and changes in the lithosphere	<i>Scope &amp; Sequence – Properties and Processes of Geosphere</i> a. Calculate the density of liquids and compare their densities with their position in a column of liquid b. Demonstrate the effect of heat on the density of a material c. Identify the source of energy that causes the uneven heating within the geosphere d. Illustrate and explain the convection currents that result from the uneven heating inside the mantel e. Demonstrate how convection currents cause earthquakes, volcanoes and the movement of crustal plates
ST	SC 5 1.6, 2.1
2. Methods exist that are used to estimate geologic time	<i>Scope &amp; Sequence – Properties and Processes of Geosphere</i> a. Given a diagram of rock layers and fossil evidence, infer the series of events that would explain the diagram b. Observe and compare rock sequences and use fossils to correlate sequences at various locations c. Use the known decay rates of radioactive isotopes present in rock to measure the time since the rock was formed
ST	SC 5 1.5, 1.6
B. Atmosphere, Weather and Climate	
1. The composition of the atmosphere affects weather changes	<i>Scope &amp; Sequence – Study of Atmosphere and Hydrosphere</i> a. Construct a scale diagram of the structure of the Earth’s atmosphere b. Compare and contrast the composition and structure of the Earth’s atmosphere c. Identify different types of air masses, fronts, and storms and predict changes that occur over time
ST	SC 5 1.6, 2.1
2. There are many factors that impact the Earth’s climate	<i>Scope &amp; Sequence – Study of Atmosphere and Hydrosphere</i> a. Investigate how changes in the atmosphere and ocean temperatures cause changes in the climate b. Explain how meteor impacts and volcanic eruptions affect the climate
ST	SC 5 1.1, 1.6
3. The Sun is the principle energy source for phenomena on the Earth’s surface	<i>Scope &amp; Sequence – Study of Atmosphere and Hydrosphere</i> a. Demonstrate, using a globe and a light source, the uneven heating of the Earth’s surface b. Create a model and explain how winds, ocean currents and the water cycle are all driven by the Sun’s energy
ST	SC 5 1.6, 2.1
4. Winds and ocean currents are produced on the Earth’s surface	<i>Scope &amp; Sequence – Study of Atmosphere and Hydrosphere</i> a. Explain how the Earth’s rotation affects wind patterns (Coriolis effect) b. Diagram the uneven heating and rotation of the Earth, which causes air masses to form and move in predictable patterns (Global Winds)
ST	SC 5 1.6, 2.1
5. Changes in the atmosphere can result in changes to the surface of the Earth	<i>Scope &amp; Sequence – Study of Atmosphere and Hydrosphere</i> a. Investigate climatic changes as evidence for past glaciation
ST	SC 5 1.1, 1.4, 1.6
C. Hydrosphere: Water – Water Cycle	
1. Ocean currents are caused by a variety of factors	<i>Scope &amp; Sequence – Study of Atmosphere and Hydrosphere</i> a. Compare the temperature and salinity between water masses to discover how density differences can generate currents
ST	SC 5 1.6
2. Large bodies of water have a major affect on climate	<i>Scope &amp; Sequence – Study of Atmosphere and Hydrosphere</i> a. Organize data to predict weather patterns associated with large bodies of water
ST	SC 5 1.8, 3.5

Standard 6: Composition and Structure of the Universe and the Motion of the Objects Within It

A. Earth, Moon, and Sun	
	Not tested at this grade level
B. Solar System	
Benchmark	Grades 8, 9, 10
1. Most objects in the solar system are in regular and predictable motion that explains such phenomena as the day, the year, phases of the Moon, seasons and eclipses	<i>Scope &amp; Sequence – Solar System</i> a. Model and describe how the Earth’s gravity pulls any object on or near the Earth toward it without touching it b. Illustrate and describe how the Sun’s gravitational pull holds the Earth and other planets in their orbits c. Create a model to illustrate how the planets’ gravitational pull keeps their Moons in orbit around them d. Illustrate the Moon’s orbit around the Earth once in about 28 days; describe what part of the Moon is lit by the Sun (50% at all times) and how much of that part can be seen from the Earth – the phases of the Moon e. Create a model or illustration explaining how solar eclipses occur f. Create a model or illustration explaining how lunar eclipses occur g. Explain how the Earth turns daily on a tilted axis and how sunlight falls more intensely on different parts of the Earth during the year h. Compare the seasons using weather patterns and the difference in the heating of the Earth’s surface
ST	SC 6 3.1
C. Stars	
1. Stars are like the Sun, some being smaller and larger, but so far away that they look like points of light	<i>Scope &amp; Sequence – Stars</i> a. Identify the Sun as the nearest star to Earth and as a producer of light b. Create an illustration to show patterns of stars in the sky called constellations c. Chart and describe how constellations appear to move across the sky nightly and how different stars can be seen in different seasons
ST	SC 6 1.6, 1.8
2. The Sun is a medium-sized star located near the edge of a disc-shaped galaxy of stars	<i>Scope &amp; Sequence – Stars</i> a. Illustrate and explain how monthly changes in the patterns of stars (constellations) occur in the sky as the Earth revolves around the Sun b. Research and compare how much closer the Sun is to the Earth than any other star c. Compare how long sunlight takes to reach the Earth in comparison to other stars d. Discuss why light from the next nearest star takes a few years to arrive
ST	SC 6 1.6, 3.5
3. Stars appear to go through a cycle of birth, development and death	<i>Scope &amp; Sequence – Stars</i> a. Describe how stars are classified b. Explain how a star evolves c. Describe why the Sun is considered to be an average star
ST	SC 6 1.1, 1.6, 3.5
D. Gravitational Forces	
1. Gravitational force from the Sun on the planets accounts for the motion of the planets. The gravitational force of the Sun on the planets depends on the masses of the planets and the Sun and the distance between them	<i>Scope &amp; Sequence – Gravitational Forces</i> a. Create a table that contains the diameters of the planets, distance from the Sun, masses of the Sun and planets, and force between them b. Label a scale model of the solar system with mass and size of each planet. Place arrows whose length is proportional to the force from each planet pointing toward the Sun. c. Describe how force changes as a planet moves in its orbit
ST	SC 6 1.6, 2.1
2. Gravitational force from the Sun on the Earth and from the Moon on the Earth accounts for the tides. The gravitational force of the Sun on the Earth and of the Moon on the Earth depends on the masses of the Sun, Earth and Moon and the distances between them	<i>Scope &amp; Sequence – Gravitatiinal Forces</i> a. Create a model that shows the relative positions of the Sun, Earth and Moon in relation to the tides b. Explain how the forces exerted by the Sun and Moon on the Earth produce the tides
ST	SC 6 3.1

# Standard 7: Processes of Scientific Inquiry

Benchmark	Grades 8, 9, 10
1. Scientific Inquiry includes the ability of students to develop and test scientifically oriented questions	<div>a. Formulate testable questions</div> <div>b. Identify the questions and concepts that guide scientific investigations</div> <div>c. Design and conduct scientific investigations</div>
ST	SC 7 1.1, 1.2, 1.3
2. Scientific inquiry relies upon gathering evidence from qualitative and quantitative observations	<div>a. Use a variety of tools and equipment to gather data (microscopes, thermometers, analog and digital meters, computers, spring scales, balances, and graduated cylinders, etc.)</div> <div>b. Measure length to the nearest millimeter, mass to the nearest gram, volume to the nearest milliliter, weight to the nearest Newton</div> <div>c. Determine the appropriate tools and techniques to collect, analyze, and interpret data</div> <div>d. Find the mean, median, and mode, calculate percent and ratios for sets of data</div>
ST	SC 7 1.4, 1.8
3. Evidence is used to formulate explanations	<div>a. Use quantitative and qualitative data to construct reasonable explanations</div> <div>b. Analyze experimental data to determine patterns, relationship, perspectives and credibility</div> <div>c. Consider the possible effects of measurement errors on calculations</div>
ST	SC 7 1.6, 1.7, 3.5
4. Scientific inquiry includes evaluation of explanations in light of scientific principles	<div>a. Evaluate the reasonableness of an explanation</div> <div>b. Make predictions supported by scientific knowledge</div> <div>c. Analyze whether evidence supports proposed explanations</div> <div>d. Recognize that explanations have changed over time as a result of new evidence</div>
ST	SC 7 3.5, 3.6
5. The nature of science relies upon communication of results and justification of explanations	<div>a. Communicate the procedures and results of investigations and explanations through:<div>⇒ verbal explanations</div><div>⇒ drawings</div><div>⇒ data tables</div><div>⇒ graphs</div><div>⇒ writings</div></div> <div>b. Communicate and defend a scientific argument</div>
ST	SC 1.8, 2.1, 4.1

Standard 8: Impact of Science, Technology and Human Activity

A. The Nature of Technology	
Benchmark	Grades 8, 9, 10
1. Social and economic forces strongly influence the direction of progress of science and technology	
ST	
2. Progress in science and technology often result in ethical, legal and public policy issues	
ST	
3. Human beings have a huge impact on other species, their environments and technology	
ST	
B. Historical Perspective	
1. Scientific theories are developed based on the body of knowledge that exists at any particular time and are tested by the continuous search for more accurate data	
ST	
2. The history of scientific thought spanned many cultures and centuries	
ST	
C. Science as a Human Endeavor	
1. Scientific information is presented through a number of credible sources, but is at times influenced in such a way to become non-credible	
ST	

# **Scope and Sequence**

# Scope and Sequence

Topic/Standard	Grade K	Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	Grade 6	Grade 7	Grade 8	Grade 9	Grade 10
Physical Science <u>Matter &amp; Energy</u> Standard 1	Describing Objects and Materials Sounds	Balancing and Measuring	Matter	Forms of Energy: Sound	Forms of Energy: Electricity		Examining Properties of Matter	Forms of Energy: Light		Properties of Matter Structure of Matter Changes in Matter Energy Transfer	
Physical Science <u>Force &amp; Motion</u> Standard 2	Relative Position Magnets	Describing Motion	Investigating Forces		Exploring Motion	Simple Machines		Exploring Forces and Motion		Describing Motion Forces Affect Motion Work and Energy	
Life Science <u>Living Systems</u> Standard 3	Five Senses Plant and Animal Behaviors	Plant and Animal Characteristics	Life Cycles of Plants and Animals			Classifying Living Things	Structure of Life	Interactions of Human Body Systems			DNA Energy Transfer Within Cells Genetics Natural Selection
Life Science <u>Ecology</u> Standard 4				Interactions and Interdependence of Organisms	Ecosystems		Ecology: Populations		Environmental Changes and Extinction  Global Consequences of Ecological Changes		Ecological Cycles Relationships Within Ecosystems  Ecological Biodiversity Interactions of Ecosystems
Earth Science <u>Earth Systems</u> Standard 5		Observing Weather	Earth Materials: Rocks & Soil	Properties of Water and the Water Cycle	Classification of Rocks & Minerals	Earth Processes: Weathering & Erosion Weather	Earth Processes: Earthquakes & Volcanoes		Properties and Processes of Geosphere  Study of the Atmosphere and Hydrosphere		
Earth Science <u>Universe</u> Standard 6	Observing the Changes in Seasons			Observing Patterns of the Sun, Moon, and Shadows				Earth and Space	Earth, Moon, and Sun Solar System Stars		

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